

Elastic-Plastic Buckling of Columns in Building Frames

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Abstract

According to Eurocode 3, the buckling strength of a compressed member is related to the one of a pin-ended column whose buckling length by means of Wood's abacuses. These take into account the stiffness of the adjacent beams and columns connected to the member ends and they have been determined under the hypothesis of an elastic behaviour of the whole structure.

However, the European buckling curves have been established from experimental and numerical studies based on a geometrically non-linear elastic plastic behaviour of the compressed members. Moreover, it is not possible to assure that all joints and adjacent elements remain elastic.

The study of the quality of this design method is presented in this paper, in the case of the elastic-plastic behaviour of a structural system composed of a compressed column and two adjacent beams for sway and non-sway buckling modes.

A parametrical study is carried out, taking into account different combinations of column and beam cross-sections and lengths, and different shapes for their initial bow imperfections. It is founded on the use of an elastic-plastic non-linear model allowing the effect of residual stresses, progressive yielding and strain-hardening to be considered.

The results show that Wood's abacuses provide safe values for the ultimate resistance of the columns in the case of sway and non-sway modes, more conservative in the second case than in the first one. They also emphasise the influence of the interaction between the initial imperfections of the columns and the relative length of the adjacent beams.

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